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TITLE: METHOD AND SYSTEM FOR ESTABLISHING COMMUNICATION TO A MOBILE MODULE

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METHOD AND SYSTEM FOR ESTABLISHING COMMUNICATION TO A MOBILE MODULE

FIELD OF THE INVENTION

This invention relates generally to telematics systems. In particular the invention relates to a method and system for establishing communication to a mobile module.

BACKGROUND OF THE INVENTION

One of the fastest growing areas of communications technology is related to automobile network solutions. The demand and potential for wireless vehicle communication, networking and diagnostic services have recently increased. Although many vehicles on the road today have limited wireless communication functions, such as unlocking a door and setting or disabling a car alarm, new vehicles offer additional wireless communication systems that help personalize comfort settings, run maintenance and diagnostic functions, place telephone calls, access call-center information, update controller systems, determine vehicle location, assist in tracking vehicle after a theft of the vehicle and provide other vehicle-related services. Drivers can call telematics call centers and receive navigational, concierge, emergency, and location services, as well as other specialized help such as locating the geographical position of a stolen vehicle and honking the horn of a vehicle when the owner cannot locate it in a large parking garage. Telematics service providers can offer enhanced telematics services by supplying a subscriber with a digital handset.

A call is received at a call center from a subscriber requesting a service. Call centers provide services to the subscriber by sending a call signal from the call center to the telematics unit in the vehicle. The vehicle must be in a standby mode or awake mode to receive the call signal. A telematics unit will remain in the standby mode for several hours after the vehicle ignition is turned off. After the standby mode is exited the telematics unit goes into a sleep/wake cycle. In one sleep/wake cycle the telematics unit is in a sleep mode for 9 minutes followed by a wake mode for 1 minute. This cycle will repeat for several hours before the telematics unit enters a continuous sleep mode. It is difficult to communicate with the telematics unit during the wake/sleep cycle, since the call center must send a call signal when the telematics unit is in the wake mode to successfully establish communication with the telematics unit.

Cellular activity and other network traffic can cause a communication device to become unavailable. Device availability effects the ability of the call center to establish communication with the telematics unit. A subscriber must wait for the call center to establish communication with the telematics unit before the service is provided.

It is desirable therefore, to provide a method and system for establishing communication to a mobile module, that overcomes the challenges and obstacles described above.

SUMMARY OF THE INVENTION

The current invention provides a method for establishing communication to a mobile module. A plurality of call signals is initiated into the mobile module from a plurality of remote communication devices based on a timed sequence. Which of the plurality of call signals has established communication with the mobile module is determined. The call signals that have not established communication are terminated based on the determination.

Another aspect of the current invention provides a computer usable medium including computer program code for establishing communication to a mobile module. The computer program code comprises: computer program code for initiating a plurality of call signals into the mobile module from a plurality of remote communication devices based on a timed sequence, computer program code for determining which of the plurality of call signals has established communication with the mobile module, and computer program code for terminating the call signals that have not established communication based on the determination.

Another aspect of the current invention provides a system for establishing communication to a mobile module. The system comprises means for initiating a plurality of call signals into the mobile module from a plurality of remote communication devices based on a timed sequence, means for determining which of the plurality of call signals has established communication with the mobile module, and means for terminating the call signals that have not established communication based on the determination.

The aforementioned and other features and advantages of the invention will become further apparent from the following detailed description of the presently preferred embodiment, read in conjunction with the accompanying drawings. The detailed description and drawings are merely illustrative of the invention rather than limiting, the scope of the invention being defined by the appended claims and equivalents thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of a system for establishing communication to a mobile module in accordance with one embodiment of the current invention;

FIG. 2 is a flow diagram of a method for establishing communication to a mobile module in accordance with one embodiment of the current invention;

FIG. 3 is a flow diagram detailing the step of initiating the plurality of call signals into the mobile module from a plurality of remote communication devices at block **220** of **FIG. 2**;

FIG. 4 is a flow diagram for a method of calculating call offsets in accordance with one embodiment of the current invention; and

FIG. 5 is a diagram illustrating an exemplary embodiment of the current invention for establishing communication to a mobile module using a first remote communication device and a second remote communication device.

DETAILED DESCRIPTION OF THE
PRESENTLY PREFERRED EMBODIMENTS

FIG. 1 is a schematic diagram of a system for establishing communication to a mobile module in accordance with one embodiment of the current invention at **100**. The system for establishing communication to a mobile module at **100** comprises: a mobile vehicle **110**, a telematics unit **120**, one or more wireless carrier systems **140**, or one or more satellite carrier systems **141**, one or more communication networks **142**, and one or more call centers **180**. Mobile vehicle **110** is a vehicle such as a car or truck equipped with suitable hardware and software for transmitting and receiving speech and data communications. Vehicle **110** has a multimedia system **118** having one or more speakers **117**.

In one embodiment of the invention, telematics unit comprises: a digital signal processor (DSP) **122** connected to a wireless modem **124**; a global positioning system (GPS) receiver or GPS unit **126**; an in-vehicle memory **128**; a microphone **130**; one or more speakers **132**; an embedded or in-vehicle phone **134** or an email access appliance **136**; and a display **138**. DSP **122** is also referred to as a microcontroller, controller, host processor, ASIC, or vehicle communications processor. GPS unit **126** provides longitude and latitude coordinates of the vehicle, as well as a time stamp and a date stamp. In-vehicle phone **134** is an analog, digital, dual-mode, dual-band, multi-mode or multi-band cellular phone.

Telematics unit **120** can store service center GPS location data, automatic number identification tables and other data files in in-vehicle memory **128**. Telematics unit **120** can set or reset calling-state indicators and can enable or disable various cellular-phone functions, telematics-unit functions and vehicle functions when directed by program code running on DSP **122**. Telematics unit **120** can send and receive over-the-air messages using, for example, a pseudo-standard air-interface function or other proprietary and non-proprietary communication links.

DSP **122** executes various computer programs and computer program code, within telematics unit **120**, which control programming and operational modes of electronic and mechanical systems. DSP **122** controls communications between telematics unit **120**, wireless carrier system **140** or satellite carrier system **141** and call center **180**. A speech-recognition engine **119**, which can translate human speech input through microphone **130** to digital signals used to control functions of telematics unit, is installed in telematics unit **120**. The interface to telematics unit **120** includes one or more buttons (not shown) on telematics unit **120**, on multimedia system **118**, or on an associated keyboard or keypad that are also used to control functions of telematics unit. A

text to speech synthesizer **121** can convert text strings to audible messages that are played through speaker **132** of telematics unit **120** or through speakers **117** of multimedia system **118**.

Speech recognition engine **119** and buttons are used to activate and control various functions of telematics unit **120**. In one embodiment, the interface to telematics unit **120** includes other forms of preference and data entry including touch-screens, wired or wireless keypad remotes, or other wirelessly connected devices such as Bluetooth-enabled devices or 802.11-enabled devices.

DSP **122** controls, generates and accepts digital signals transmitted between telematics unit **120** and a vehicle communication bus **112** that is connected to various vehicle components **114**, various sensors **116**, and multimedia system **118** in mobile vehicle **110**. DSP **122** can activate various programming and operation modes, as well as provide for data transfers. In facilitating interactions among the various communication and electronic modules, vehicle communication bus **112** utilizes bus interfaces such as controller-area network (CAN), J1850, International Organization for Standardization (ISO) Standard 9141, ISO Standard 11898 for high-speed applications, and ISO Standard 11519 for lower speed applications.

Mobile vehicle **110** via telematics unit **120** sends and receives radio transmissions from wireless carrier system **140**, or satellite carrier system **141**. Wireless carrier system **140**, or satellite carrier system **141** is any suitable system for transmitting a signal from mobile vehicle **110** to communication network **142**.

Communication network **142** includes services from mobile telephone switching offices, wireless networks, public-switched telephone networks (PSTN), and Internet protocol (IP) networks. Communication network **142** comprises a wired network, an optical network, a fiber network, another wireless network, or any combination thereof. Communication network **142** connects to mobile vehicle **110** via wireless carrier system **140**, or satellite carrier system **141**.

Communication network **142** can send and receive short messages according to established protocols such as dedicated short range communication standard (DSRC), IS-637 standards for short message service (SMS), IS-136 air-interface standards for SMS, and GSM 03.40 and 09.02 standards. In one embodiment of the invention, similar to paging, an SMS communication is posted along with an intended recipient, such as a communication device in mobile vehicle **110**.

Call center **180** is a location where many calls are received and serviced at the same time, or where many calls are sent at the same time. In one embodiment of the invention, the call center is a telematics call center, facilitating communications to and from telematics unit **120** in mobile vehicle **110**. In another embodiment, the call center **180** is a voice call center, providing verbal communications between a communication service advisor **185**, in call center **180** and a subscriber. In another embodiment, call center **180** contains each of these functions.

Communication services advisor **185** is a real advisor or a virtual advisor. A real advisor is a human being in verbal communication with a user or subscriber. A virtual advisor is a synthesized speech interface responding to requests from user or subscriber. In one embodiment, the virtual advisor includes one or more recorded messages. In another embodiment, the virtual advisor generates speech messages using a call center based text to speech synthesizer (TTS). In another embodiment, the virtual advisor includes both recorded and TTS generated messages.

Call center **180** provides services to telematics unit **120.** Communication services advisor **185** provides one of a number of support services to a subscriber. Call center **180** can transmit and receive data via a data signal to telematics unit **120** in mobile vehicle **110** through wireless carrier system **140**, satellite carrier systems **141**, or communication network **142**.

Call center **180** can determine mobile identification numbers (MINs) and telematics unit identifiers associated with a telematics unit access request, compare MINs and telematics unit identifiers with a database of identifier records, and send calling-state messages to the telematics unit **120** based on the request and identification numbers.

In one embodiment of the invention call center has a plurality of remote communication devices, such as a bank of modems **182**, used to initiate call signals into telematics unit **120**. The modems **182** dial the telematics unit **120** using the MIN associated with that telematics unit. Telematics unit **120**, through embedded phone **134**, receives the call signals. Call center **180** controls modems **182** and can determine which modem has established communication with telematics unit **120**. Call center **180** also determines a service priority assigned to a requested service. Backend connections **186** to modems **182** store connection data regarding attempts to establish communication between the modems **182** and the telematics unit **120**. Connection data is stored in call center database **188**. Call Center **180** uses connection data to calculate call offsets and to optimize communication to telematics unit **120**.

Communication network **142** connects wireless carrier system **140** or satellite carrier system **141** to a user computer **150**, a wireless or wired phone **160**, a handheld device **170**, such as a personal digital assistant, and call center **180**. User computer **150** or handheld device **170** has a wireless modem to send data through wireless carrier system **140**, or satellite carrier system **141**, which connects to communication network **142**. In another embodiment, user computer **150** or handheld device **170** has a wired modem, which connects to communications network **142**. Data is received at call center **180**. Call center **180** has any suitable hardware and software capable of providing web services to help transmit messages and data signals from user computer **150** or handheld device **170** to telematics unit **120** in mobile vehicle **110**.

FIG. 2 is a flow diagram of a method for establishing communication to a mobile module in accordance with one embodiment of the current invention at **200**. The method for establishing communication to a mobile module, such as a telematics unit, at **200** begins (block **205**) when a call is received at a call center from a subscriber requesting a service (block **210**). The call center initiates a plurality of call signals into the mobile module from a plurality of remote communication devices (block **220**). A number of remote communication devices from which to initiate the plurality of call signals is determined based on a service priority assigned to a requested service (block **230**). The service priority is determined from a service priority table that comprises a list of services and a service priority, such as high or low, that is assigned to each service. Call signals are initiated in a timed sequence wherein each call signal in the timed sequence is separated by a call time increment. Each successive call signal has a call signal position in the timed sequence irrespective of which remote communication device initiates the call signal. The first call signal generated is in position 1, the second call signal generated is in position 2, and so on. Which of the plurality of call signals has established communication with the mobile module is determined (block **240**).

The determination is made by detecting whether a call signal in the timed sequence has established communication with the mobile module prior to initiating a next call signal (block **245**). A call signal has established communication with the mobile module when an authenticated connection, between the remote communication device and the mobile module, occurs. The mobile module accepts the call signal and sends a connection signal back to the remote communication device. If a call signal in the timed sequence has not established communication with the remote module, a next call signal is generated (block **247**) and the detection (block **245**) is repeated. If a call signal in the timed sequence has established communication with the remote module, a next call signal is not generated and the call signals that have not established

communication are terminated (block **250**) and the method ends (block **295**). The call signals are terminated by sending a disengage command to the remote communication devices that are active but have not established communication with the mobile module. The hang up command is sent when the remote communication devices are modems

FIG. 3 is a flow diagram detailing the step of initiating the plurality of call signals into the mobile module from a plurality of remote communication devices at block **220** of **FIG. 2**. The step of initiating the plurality of call signals into the mobile module from a plurality of remote communication devices at **300** begins (block **305**) when the plurality of remote communication devices are initialized at the call center (block **310**). The timed sequence starts when the first remote communication device initiates a call signal into the mobile module at a first call time (block **320**). A call time increment is calculated using the call signal position in the timed sequence "N" and a determined time constant "X" (block **330**). The call time increment is calculated based on the formula (N-1)X. The time constant is determined empirically, for any mobile module, based on the module's performance in its respective network or location. A next call time is determined by adding the call time increment to the first call time (block **340**) and a next call signal is initiated at the next call time (block **350**). The step repeats until communication is established between a remote communication device and the mobile module and the step ends (block **395**).

FIG. 4 is a flow diagram for a method of calculating call offsets in accordance with one embodiment of the current invention. The method for calculating call offsets at **400** begins (block **405**) with monitoring the plurality of call signals into the mobile module for connection data (block **410**). Backend connections to the remote communication devices are able to store information about the outbound call signals. The connection data for the mobile module is written to a connection database (block **420**). Connection data for a particular mobile module comprises information regarding the optimal time in the mobile

module's wakeup period to initiate a call signal to the mobile module and the time required for establishing communication with the mobile module. This connection data is then used to calculate a call offset for the module (block **430**). The call offset is amount of time elapsed from when the first call signal is sent to when communication is established to the mobile module. The call offsets are written to the connection database (block **440**). The call offsets are used to optimize communications into the mobile module. By minimizing the value of the call offset the call center can determine the optimal time in the mobile module's wake up period to initiate call signals. The method ends (block **495**).

FIG. 5 is a diagram illustrating an exemplary embodiment of the current invention for establishing communication to a mobile module using a first remote communication device and a second remote communication device at **500**. The first communication device is modem A **510** and the second communication device is modem B **520** and the mobile module is a telematics unit **120**. The timed sequence starts **507** when modem A **510** initiates a first call signal **515** into the telematics unit at the first call time **517**. Modem B **520** initiates a second call signal **525** into the telematics unit **120** at the first call time plus the time increment (N-1)X seconds **527**, where N is the call signal's position in the timed sequence and X is the determined time constant. Here, N=2 since modem B device initiates the second call signal. The next call signal, which is a third call signal **535**, is generated at the first call time plus (N-1)X seconds **537**. In this example modem A **510** initiates the third call signal **535** in the timed sequence (N=3). Call signal generation continues until communication is established with the telematics unit **120**. Communication is established with telematics unit only when the telematics unit is in a wake state **570**. If a telematics unit is in a sleep state **580** or is unavailable **590** the call signal can not establish communication with the telematics unit **120**.

While embodiments of the invention disclosed herein are presently considered to be preferred, various changes and modifications can be made without departing from the spirit and scope of the invention. The scope of the invention is indicated in the appended claims, and all changes that come within the meaning and range of equivalents are intended to be embraced therein.